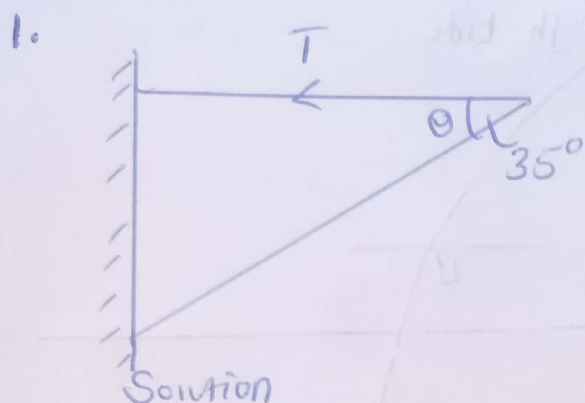


PHYSICS HOMEWORK



$$L = \text{Length} = 3 \text{ m}$$

$$W = \text{Weight} = 550 \text{ N}$$

T is tension

$$T \sin \theta (L) = W \cos \theta \left(\frac{L}{2} \right)$$

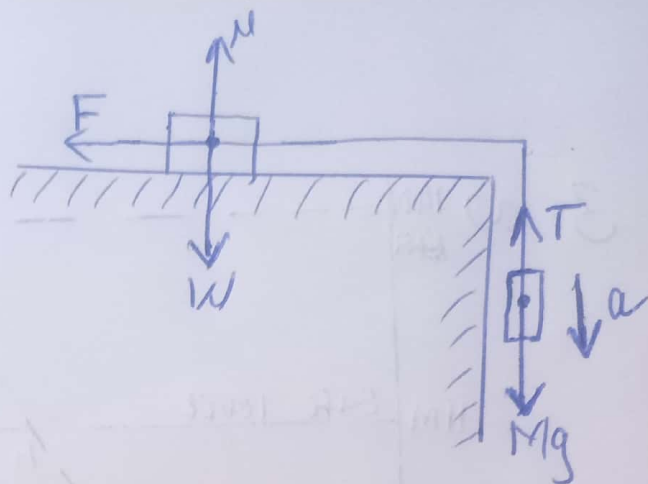
$$\therefore T = \left(\frac{W}{2 \tan \theta} \right) = \frac{550}{2 \times \tan 35}$$

$$T = 392.7407019 \text{ N}$$

$$\approx 392.74 \text{ N}$$

(2. decimal places)

2.



When the block is not moving
net force is zero,

$$N - W = 0$$

Net horizontal force on the
block gives the acceleration

$$Ma = T - F$$

$$\therefore T = Ma + F$$

$$ma = mg - T$$

$$ma = mg - \underbrace{(Ma + F)}_T$$

$$ma = mg - Ma - F$$

$$ma + Ma = mg - F$$

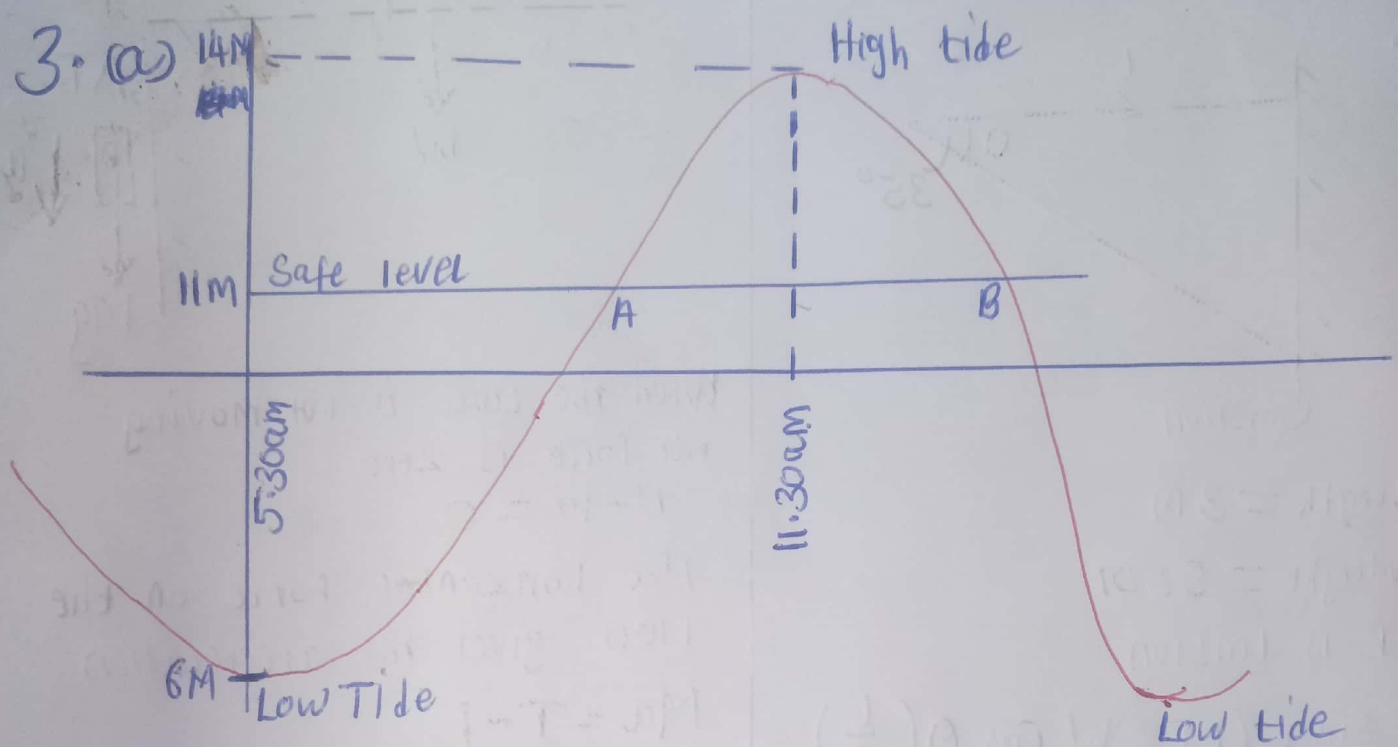
$$(m + M)a = mg - F$$

$$\cancel{a = mg +}$$

$$a = \frac{mg - F}{m + M}$$

$$= \frac{(2 \times 9.8) - 6}{2 + 8}$$

$$= \frac{13.6}{10} = 1.36 \text{ m/s}^2$$



- The figure shows variation of water level from low tide to high tide as a function of time.
 - As seen from the figure, starting from low tide to high tide takes half of the period of S.H.M.
 - Hence period = $2 \times 6 \text{ hours} = 12 \text{ hours}$
 - At low tide, water level 6M, at high tide, water level is 14M.
- Hence equilibrium position is 10M and Amplitude is 4M
- Hence Amplitude = 4M
- Period = 12 hours

3 (b) Show that the earliest time that a ship can pass through the entrance is approximately 9 am.

Solution

Equation of S.H.M is,

$$h(t) = -4 \cos\left(\frac{2\pi t}{12}\right) + 10 \quad \text{where } t \text{ is time}$$

and $t=0$ is at 5:30 am.

Time for water to reach 11 m point A is given by;

$$11 = -4 \cos\left(\frac{2\pi t}{12}\right) + 10$$

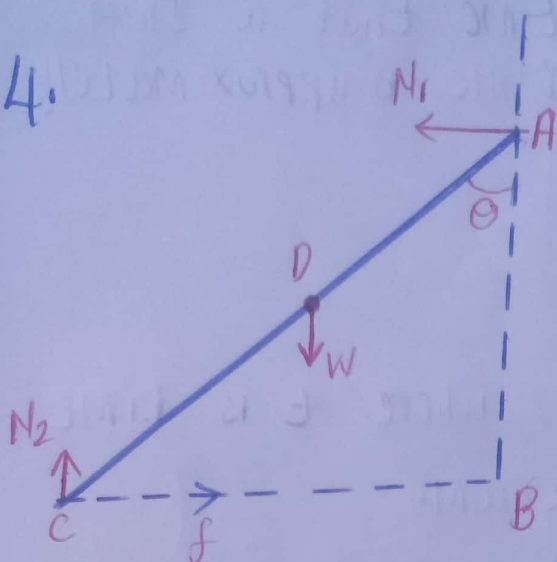
$$\cos\left(\frac{2\pi t}{12}\right) = -0.25, \Rightarrow \left(\frac{2\pi t}{12}\right) = \cos^{-1}(-0.25)$$
$$= 1.823$$

Hence we get $t = 3.48 \text{ hours} = 3 \text{ hrs } 29 \text{ min}$

Hence water level 11 m as marked by point A will reach at $(5 \text{ hr } 30 \text{ min}) + (3 \text{ hr } 29 \text{ min}) \approx 9.00 \text{ am}$

$\approx 9.00 \text{ am.}$

4.



$$AC = 3\text{m}$$

$$\theta = 60^\circ$$

$$W = 155\text{N}$$

Solution

(a) Here, $N_1 = f$

Torque about C:

$$N_1(AC) \cos \theta = W(DC) \sin \theta$$

$$N_1 = \frac{W(DC) \sin \theta}{(AC) \cos \theta}$$

$$N_1 = \frac{155 \times 1.5 \tan 60^\circ}{3}$$

$$= 134.23\text{ N}$$

ie $N_1 > \text{max friction} \Rightarrow \text{ladder slips}$

(b) Determine the angle that makes the ladder to slip.

Solution

For this to happen,

$$N_1 = f = 120\text{N}$$

$$N_1 = \frac{W(DC)}{AC} \tan \theta$$

$$\Rightarrow \frac{120 \times 3}{155 \times 1.5} = \tan \theta$$

$$\tan \theta = 1.548$$

$$\therefore \theta = \tan^{-1}(1.548)$$

$$= 57.13^\circ$$

4 (C) Direction of friction force

Ans $\rightarrow$ friction will be upwards by the wall.

5. Block's speed after 4.2 sec.

Solution:

Mass of block, $M = 8.5 \text{ kg}$

Angle of inclination $= 20^\circ$

Friction force $= 7.2 \text{ N}$

Initial velocity $= 0$

Time of travel $= 4.2 \text{ s}$

Net force along, ~~the~~ parallel to the plane is;

$$F_{\text{net}} = Mg \sin 20 - \text{Friction}$$

$$F_{\text{net}} = 8.5 \times 9.8 \sin 20 - 7.2$$

$$8.5 \times a = (8.5 \times 9.8 \times 0.342) - 7.2 = 21.3$$

Therefore acceleration along incline plane is $a = \frac{21.3}{8.5}$

$$\Rightarrow \frac{21.3}{8.5} = 2.5 \text{ m/s}^2$$

Using $V = U + at$

$$V = 0 + 2.5 \times 4.2$$

$$= 10.5 \text{ m/s}$$